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BREEDING TERRITORY STABILITY OF RESIDENT SPARROWS IN THE CENTRAL MONTE DESERT, ARGENTINA

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Estabilidad territorial durante la época reproductiva de aves granívoras residentes en el Desierto del Monte central, Argentina.

Key words: Ringed Warbling-Finch, Many-colored Chaco-Finch, Rufous-collared Sparrow, Emberizidae, Thraupidae, *Poospiza torquata*, *Saltatricula multicolor*, *Zonotrichia capensis*, territory.

INTRODUCTION

The knowledge about territorial systems of New World birds come primarily from mesic environments of the tropics and temperate North America. Long-term pair bonds and stable territories (even year-round) are common in the tropics, while rare in North-temperate birds (Morton *et al.* 2000). Therefore, territorial stability (i.e., stable locations of territories and territory owners) has been suggested to be similar among birds with similar life history strategies (Stutchbury & Morton 2001, 2008). That is because tropical species are mostly resident and with high survival, maintaining territories and pairs through time. In contrast, species inhabiting temperate North America are commonly migrants and with high mortality during winters, hence territory vacancies after migration and mate deaths are frequent. These differences are often generalized as typical traits of "tropical" or "temperate" species, despite the lack of knowledge on South-temperate birds. There are only a few published studies reporting mate or territory fidelity in passerines of temperate South America, and most of them were performed with cavity nesters and nest-boxes. For example, territory fidelity was reported as common at least for one of the sexes in the Thorn-tailed Rayaditos (*Aphrastura spinicauda*, Cornelius 2008) and Strange-tailed Tyrants

(*Alectrurus risora*, DiGiacomo *et al.* 2011). Palmerio & Massoni (2009) reported that both sexes of Saffron Finches (*Sicalis flaveola*) are usually present during consecutive breeding seasons but there is no information on whether they use the same territories or pair with the same mates. In other studies, pair bonds' duration of Southern House Wrens (*Troglodytes musculus*, LaBarbera *et al.* 2012) and territory fidelity of White-rumped Swalows (*Tachycineta leucorrhoa*, Bulit & Massoni 2011) were not different to those reported for the same or similar species in North-temperate environments. In summary, information is scarce, patterns are not univocal, and studies rarely report fidelity to both territories and mates.

Here we report information on stability of territory locations, and mate and territory fidelity in three resident species of sparrows in a desert of temperate South America: Rufous-collared Sparrow (*Zonotrichia capensis*), Ringed Warbling-Finch (*Poospiza torquata*), and Many-colored Chaco-Finch (*Saltatricula multicolor*). These sparrows have resident populations (Sagario *et al.* in press) and high interannual survival (Sagario 2011) in the central Monte desert of Argentina. If these life history characteristics are related to the territorial behavior of birds we expect both territory locations and pairs to be stable throughout the years. This paper aims to test these predictions.

METHODS

We worked in the open *Prosopis flexuosa* woodland of the Biosphere Reserve of Ñacuñán, MAB-UNESCO (34º03'S–67º54'W), which is located in the central Monte Desert, Mendoza province, Argentina. The open woodland presents mesquite (*Prosopis flexuosa*) and chañar (*Geoffroea decorticans*) trees scattered within a matrix of creosote shrubs (almost exclusively *Larrea divaricata*), other tall shrubs with low cover (e.g., *Capparis atamisquea*, *Atriplex lampa*, *Condalia microphylla*), perennial grasses and annual forbs. Ñacuñan's climate is dry and temperate, and annual rainfall (349 mm, n = 31 years) is > 75% during spring and summer and highly variable between years (for a more detailed description see Lopez de Casenave 2001).

We surveyed birds with mist-nets during five breeding seasons (2004–2008) during spring and summer (November and February, respectively, for a more detailed description see Sagario *et al.* in press). Birds were sexed according to their cloacal protuberance or brood patch development (Ralph *et al.* 1995) and marked with numbered aluminum bands and unique combinations of color bands. We also trapped and banded focal males with the use of playback. After each netting period, we made an intense search for banded birds in the permanent plot and 50 to 100 m beyond its limit (i.e., covering a minimum total search area of 18 ha) during the first four hours after sunrise and the last two before sunset, for a minimum of 10 days or until no new banded individuals were seen after 10 hours of search. We systematically walked through the search area at least once per day. Every time a banded bird was seen we registered its location, its identity and whether the bird was paired (and the identity of its mate, if banded). In the case of males, we also registered locations of territorial vocalizations or aggressive interaction. The map of the plot and location of singing males were geo-referenced and incorporated into a Geographic Information System (GIS) in ArcView 3.3 (ESRI 2002). Locations of singing males were considered for territory mapping, and identification of most individuals with color bands and the record of aggressive interactions and simultaneous songs facilitated the demarcation of territories (for a more detailed description see Sagario & Cueto in press). We calculated the centroid of the group of reloca-

TABLE 1. Average distance (m) between centroids of territories of three species of sparrows in two consecutive years in the central Monte Desert, Argentina. Number of territories evaluated in each comparison are shown (between parentheses) after the distance, while number of territories known to be of different individuals/pairs are shown after the species name (i.e., some territories were evaluated in more than one pair of breeding seasons).

Species	2004–2005	2005–2006	2006–2007	2007–2008	Range
Rufous-collared Sparrow (7)	38 (1)	24 (3)	46 (7)	-	6–107
Ringed Warbling-Finch (5)	56 (1)	33 (2)	25 (5)	-	13–56
Many-colored Chaco-Finch (6)	60 (1)	46 (6)	44 (5)	31 (1)	10–103

tions of the same singing male (i.e., the center of the territory) using the "Center of Mass v.1.b" extension for ArcView (Jenness 2006). We used the distance between the centroids in consecutive breeding seasons to evaluate the stability of territories and compared distances between species using a one-way ANOVA.

Among the females and males we calculated territory fidelity by registering the proportion of birds that were seen in the same territory during consecutive breeding seasons (same), in a different territory (new) or that were not seen again (unknown). For breeding pairs we calculated mate fidelity by registering if during the following breeding season the pair consisted of the same two individuals (same), of one of the members of the pair and a different mate (new) or if none of the individuals was seen again (unknown). We made comparisons between sexes and species using the Test for Differences for Two or More than Two Proportions (hereafter Tests DTP and DMTP, respectively; Zar 2010). Values of territory and mate fidelity are minimum estimates given that many times the identity of the individuals in the plot and its vicinities could not be established, so unknown fates may include deaths, emigrations or oversights.

RESULTS

Distances between centroids of territories in consecutive years were similar and short on every pair of years (Table 1), and the overall mean distance throughout the study did not differ between species (ANOVA: $F_{2,31}$ = 0.766, P = 0.474; mean (± SE) = 39.3 ± 4.5 m). The most common for the three species was to maintain the same territories (Table 2), even though territory fidelity was variable between years (Table 2). Also, overall territory fidelity throughout the study did not differ either between sexes (Test DTP: χ^2_1 = 0.503, P = 0.478 for Rufous-collared Sparrow; χ^2_1 = 0.032, P = 0.858 for Ringed Warbling-Finch; and χ^2_1 = 0.623, P = 0.430 for Many-colored Chaco-Finch) or species (Test DMTP: χ^2_2 = 0.529, P = 0.768 for males and χ^2_2 = 0.150, P = 0.928 for females). Often, territory and mate fidelity was unknown, but every time a bird was not seen in consecutive years it was also not seen in any other year of the study. In accordance, the record of new pairs was rare (Table 3) and we only registered one case of territory switching, when a female Ringed Warbling-Finch was recorded on the first year in a territory (2005) and in subsequent years in an adjacent one (2006–2008, Table 2). We did not find differences between species when comparing pair fidelity (Test DMTP: χ^2_2 = 0.467, P = 0.792, Table 3).

DISCUSSION

For every species, territory locations were stable and in most cases pairs bonds were maintained. Despite sampling size is small and conclusions should be cautious our results

TABLE 2. Percentages of males and females occupying the same or a new territory in two consecutive years for Rufous-collared Sparrow (RCS), Ringed Warbling-Finch (RWF), and Many-colored Chaco-Finch (MCCF) in the central Monte Desert, Argentina. Unknown fates are also shown, as well as total percentages pooling the data. Sample sizes for positive cases of each category are shown (between parentheses) after the percentages, while number of individuals known to be different are shown below each species acronym for males and females (i.e., some individuals were evaluated in more than one pair of breeding seasons).

	2004–2005	2005–2006	2006–2007	2007–2008	Total
RCS					
Males (10) same	100% (4)	100% (7)	78% (7)	56% (5)	79% (23)
unknown	-	-	22% (2)	44% (4)	21% (6)
Females (5) same	100% (1)	100% (3)	100% (4)	20% (1)	69% (9)
unknown	-	-	-	80% (4)	31% (4)
RWF					
Males (10) same	100% (4)	83% (5)	75% (6)	43% (3)	72% (18)
unknown	-	17% (1)	25% (2)	57% (4)	28% (7)
Females (5) same	-	75% (3)	75% (3)	75% (3)	75% (9)
new	-	25% (1)	-	-	8% (1)
unknown	-	-	25% (1)	25% (1)	17% (2)
MCCF					
Males (10) same	100% (4)	83% (5)	89% (8)	50% (4)	79% (23)
unknown	-	17% (1)	11% (1)	50% (4)	21% (6)
Females (8) same	100% (3)	100% (4)	50% (3)	33% (1)	69% (11)
unknown	-	-	50% (3)	66% (2)	31% (5)

suggest high stability in the territorial system of Rufous-collared Sparrow, Ringed Warbling-Finch, and Many-colored Chaco-Finch. Field observations also support this idea. For example, for all species, there was at least a pair which remained together in the same territory for at least four consecutive years, and except for one case, every time a bird was seen with a new partner the former partner was not seen again, suggesting either that the bird died or abandoned our search area. In several occasions, we observed one or both individuals of the pair feeding or collecting food for the chicks and/or feeding the juveniles, and some males of Ringed Warbling-Finch and Many-colored Chaco-Finch were seen also feeding their mates within the defended areas (Sagario 2011). Long (or even life-time) pair bonds and biparental care are closely linked to monogamy (see Wittenberger & Tilson 1980 and references therein). However, extra pair fertilizations (EPF) were many times registered in species with those characteristics, and are not rare among sparrows (Petren *et al.* 1999). Furthermore, EPF have been previously reported in tropical populations of Rufous-collared Sparrow (Eikenaar *et al.* 2013). Extra pair copulations are expected to be secretive, so our lack of observations of territorial males or females in neighboring territories or pair members mating with a different individual is not conclusive. Also, we captured floaters with mist nets many times (i.e., males with cloacal protuberance that were not registered as territory owners). These indirect evidences let us suspect that EPF may be occurring but until specific studies are performed the genetic monogamy of these sparrows in our study area remains untested. In summary, despite more studies

TABLE 3. Percentages of breeding pairs known to be composed by the same individuals in two consecutive years (same) or by only one of them (new) for Rufous-collared Sparrow (RCS), Ringed Warbling-Finch (RWF), and Many-colored Chaco-Finch (MCCF) in the central Monte Desert, Argentina. Unknown fates are also shown, as well as total percentages pooling the data. Sample sizes for positive cases of each category are shown (between parentheses) after the percentages, while number of different pairs are shown after the species name (i.e., some pairs were evaluated in more than one pair of breeding seasons).

	2004–2005	2005–2006	2006–2007	2007–2008	Total
RCS (4)					
same	100% (1)	100% (2)	66% (2)	33% (1)	67% (6)
unknown	-	-	33% (1)	66% (2)	33% (3)
RWF (6)					
same	-	66% (2)	75% (3)	75% (3)	73% (8)
new	-	33% (1)	-	-	9% (1)
unknown	-	-	25% (1)	25% (1)	18% (2)
MCCF (6)					
same	66% (2)	100% (3)	40% (2)	33% (1)	57% (8)
new	-	-	20% (1)	33% (1)	14% (2)
unknown	33% (1)	-	40% (2)	33% (1)	29% (4)

are needed, our results and observations suggest that these sparrows in the central Monte Desert might be at least socially monogamous, with long-term pair bonds, and stable territories.

Territorial behavior and reproductive activities among sparrows of the central Monte desert are markedly seasonal (Blendinger 2005, Sagario & Cueto in press), as is commonly observed in species inhabiting temperate regions of North America (Stutchbury & Morton 2001). However, the high survival (Sagario 2011) and the sedentary lifestyle (Sagario *et al.* in press) of these sparrows are traits more usually found in tropical species of the New World (Stotz *et al.* 1996, Martin 1996, Stutchbury & Morton 2001, 2008). These last traits were in accordance to the territorial stability found in this study, as has been many times shown in tropical species (e.g., Freed 1987, Lefebvre *et al.* 1992, Morton & Derricson 1996). This study contributes to the knowledge of the many times assumed similarities between tropical and South-temperate birds, but that have seldom been tested.

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